

Remarks/Arguments

Applicants hereby request further examination of the subject application in view of the amendments and remarks presented herein.

Election/Restrictions

Applicants hereby affirm initial election of Group I, Claims 1-18, without traverse, drawn to apparatus. Applicants further affirm subsequent election of species Group I-a (Figure 2), Claims 1-7, without traverse, drawn to a system having a reformer/heat exchanger/scrubber/ and fuel cell.

Specification

The Abstract is objected to by the examiner. Applicants have amended the abstract herein, paragraph [0020], for better description of the elected invention.

Claim Rejections – 35 USC § 112

Claims 5-6 are rejected under 35 USC § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Claims 5-6 have insufficient antecedent basis for “said catalytic fuel reactor”. Applicants respectfully traverse the rejection.

Applicants have canceled dependent Claims 5 & 6 drawn to a non-elected invention (I-b) thereby overcoming the rejection.

Claim Rejections – 35 USC § 102

Claims 1 and 5 & 6 are rejected under 35 USC § 102(b) as being anticipated by Bonville (US 6,156,084). Applicants respectfully traverse the rejection.

Applicants have amended Claim 1 herein to better describe the “directly connected” structural elements and sequencing of the invention components that Bonville fails to teach and claim.

Firstly, Bonville teaches {Col. 2, lines 51-62; Col. 4, lines 37-44; Figure 1} and claims {Claims 1, 4, 5, and 6} delivery of fuel to a desulfurizer [8] as an element of his invention. Conversely, the applicants' invention teaches {Fig. 2; and Paragraph [0015]} and claims {Claim 1} the delivery of fuel directly to the reformer [11] without passage through a desulfurizer. Bonville also teaches the specific use of a nickel desulfurizer bed [8] whereas the applicants' invention teaches the use of carbon fiber composite molecular sieve scrubber [13] directly connected to the heat exchanger for the removal of sulfur. Bonville teaches a desulfurizer and other components requiring chemical reactions/processes whereas the applicants' invention, as a whole, uses simpler physical reactions/processes.

Secondly, Bonville teaches {Col. 5, lines 5-10, Fig. 1} a shift converter [30] for oxidation of carbon monoxide to carbon dioxide thereby decreasing the concentration of carbon monoxide and increasing the concentration of hydrogen. Conversely, the applicants' invention has no shift converter and the shift converter is not necessary for the invention. The applicants teach {Paragraph 0015} and claim {Claim 1} a scrubber [13] directly connected to the heat exchanger [12] without the use of a shift converter. The applicants scrubber removes CO, CO₂, and H₂S thereby eliminating the need for a shift converter and desulfurizer.

Claims 5 & 6 have been canceled.

The rejection is overcome, and applicant respectfully requests withdrawal thereof.

Claim Rejections – 35 USC § 103

Claims 2 & 3 are rejected under 35 USC § 103 as being unpatentable over Bonville (US 6,156,084) in view of Hayes (5,709,914). Applicants respectfully traverse the rejection.

Applicants have amended Claim 1, to which Claims 2 & 3 depend, to better describe the “directly connected” structural elements and sequencing of the invention components that Bonville and Hayes fail to teach and claim.

Firstly, Bonville teaches {Col. 2, lines 51-62; Col. 4, lines 37-44; Figure 1} and claims {Claims 1, 4, 5, and 6} delivery of fuel to a desulfurizer [8] as an element of his invention. Conversely, the applicants' invention teaches {Fig. 2; and Paragraph [0015]} and claims {Claim 1} the delivery of fuel directly to the reformer [11] without passage through a desulfurizer. Bonville also teaches the specific use of a nickel desulfurizer bed [8] whereas the applicants'

invention teaches the use of carbon fiber composite molecular sieve scrubber [13] directly connected to the heat exchanger for the removal of sulfur. Bonville teaches a desulfurizer and other components requiring chemical reactions/processes whereas the applicants' invention, as a whole, uses simpler physical reactions/processes.

Secondly, Bonville teaches {Col. 5, lines 5-10, Fig. 1} a shift converter [30] for carbon monoxide reduction. Conversely, the applicants' invention has no shift converter and the shift converter is not necessary for the invention. The applicants teach {Paragraph 0015} and claim {Claim 1} a scrubber [13] directly connected to the heat exchanger [12] without the use of a shift converter. The applicants scrubber removes CO, CO₂, and H₂S thereby eliminating the need for a shift converter and desulfurizer.

Thirdly, Hayes heat transfer device [12] is a matrix of any of several containment or support materials, including carbon foam, and an endothermic agent, thus a composite fabric endothermic material. The basis for such a device is fusion, i.e., melting, which is an endothermic physical process, and solidification, which is an exothermic physical process. Hayes achieves temperature control via the use of materials that have a fusion temperature at the temperature of interest. Hayes also considers temperature control via an endothermic chemical reaction using materials that react at a particular temperature of interest. This teaching of Hayes of the use of endothermic fusion or endothermic chemical reaction teaches directly away from our invention in which the heat exchanger function depends exclusively on the heat transfer characteristics of the carbon foam and not in any way on endothermic fusion or endothermic chemical reaction.

Fourthly, Bonville teaches the use of an ammonia scrubber [52] after the two selective oxidizers [44 and 50] whereas the applicants' invention teaches the use of the CFCMS [13] to remove the chemically reduced forms of the contaminants. Bonville teaches away from the applicants' invention.

The rejection is overcome, and applicant respectfully requests withdrawal thereof.

Claim 4 is rejected under 35 USC § 103 as being unpatentable over Bonville (US 6,156,084) in view of Wilson (5,827,355). Applicants respectfully traverse the rejection.

Applicants have amended Claim 1, to which Claim 4 depends, to better describe the “directly connected” structural elements and sequencing of the invention components that Bonville and Wilson fail to teach and claim.

Firstly, Bonville teaches {Col. 2, lines 51-62; Col. 4, lines 37-44; Figure 1} and claims {Claims 1, 4, 5, and 6} delivery of fuel to a desulfurizer [8] as an element of his invention. Conversely, the applicants’ invention teaches {Fig. 2; and Paragraph [0015]} and claims {Claim 1} the delivery of fuel directly to the reformer [11] without passage through a desulfurizer. Bonville also teaches the specific use of a nickel desulfurizer bed [8] whereas the applicants’ invention teaches the use of carbon fiber composite molecular sieve scrubber [13] directly connected to the heat exchanger for the removal of sulfur. Bonville teaches a desulfurizer and other components requiring chemical reactions/processes whereas the applicants’ invention, as a whole, uses simpler physical reactions/processes.

Secondly, Bonville teaches {Col. 5, lines 5-10, Fig. 1} a shift converter [30] for carbon monoxide reduction. Conversely, the applicants’ invention has no shift converter and the shift converter is not necessary for the invention. The applicants teach {Paragraph 0015} and claim {Claim 1} a scrubber [13] directly connected to the heat exchanger [12] without the use of a shift converter. The applicants scrubber removes CO, CO₂, and H₂S thereby eliminating the need for a shift converter and desulfurizer.

Thirdly, Bonville teaches the removal of CO via a “selective oxidizer,” [44], which converts CO to CO₂, and thence to a second “selective oxidizer,” [50] which lowers the CO to <10 ppm. In contrast, the CO and CO₂ are removed in the applicants’ invention by the CFCMS [13] scrubber using physical adsorption and no selective oxidation. Additionally, the applicants’ invention teaches the removal of CO directly by adsorption of CO on the activated carbon without conversion to CO₂. Thus, Bonville teaches away from the applicants’ invention.

Fourthly, Bonville teaches the use of an ammonia scrubber [52] after the two selective oxidizers [44 and 50] whereas the applicants’ invention teaches the use of the CFCMS [13] to remove the chemically reduced forms of the contaminants. Bonville teaches away from the applicants’ invention.

The rejection is overcome, and applicant respectfully requests withdrawal thereof.

Claim 7 is rejected under 35 USC § 103 as being unpatentable over Bonville (US 6,156,084) in view of Asou (US 2002/0150800). Applicants respectfully traverse the rejection.

Applicants have amended Claim 1, to which Claim 7 depends, to better describe the “directly connected” structural elements and sequencing of the invention components that Bonville and Asou fail to teach and claim.

Firstly, Bonville teaches {Col. 2, lines 51-62; Col. 4, lines 37-44; Figure 1} and claims {Claims 1, 4, 5, and 6} delivery of fuel to a desulfurizer [8] as an element of his invention. Conversely, the applicants’ invention teaches {Fig. 2; and Paragraph [0015]} and claims {Claim 1} the delivery of fuel directly to the reformer [11] without passage through a desulfurizer. Bonville also teaches the specific use of a nickel desulfurizer bed [8] whereas the applicants’ invention teaches the use of carbon fiber composite molecular sieve scrubber [13] directly connected to the heat exchanger for the removal of sulfur. Bonville teaches a desulfurizer and other components requiring chemical reactions/processes whereas the applicants’ invention, as a whole, uses simpler physical reactions/processes.

Secondly, Bonville teaches {Col. 5, lines 5-10, Fig. 1} a shift converter [30] for carbon monoxide reduction. Conversely, the applicants’ invention has no shift converter and the shift converter is not necessary for the invention. The applicants teach {Paragraph 0015} and claim {Claim 1} a scrubber [13] directly connected to the heat exchanger [12] without the use of a shift converter. The applicants scrubber removes CO, CO₂, and H₂S thereby eliminating the need for a shift converter and desulfurizer.

Thirdly, the examiner states that that “Asou teaches ...a carbon monoxide scrubber/purifying unit (5)...” The term “scrubber” is not used in Asou. This is important because “scrubber” implies a removal or scrubbing of a constituent of the gas, whereas Asou teaches only a “purifying unit” filled with “a CO removing (purifying) catalyst.” The function of the CO removing (purifying) catalyst is not explicitly stated by Asou, but a catalyst by definition is used to change the rate of a chemical reaction, which, in this case, is a reaction that converts CO to a reaction product [the product is not stated but would be CO₂]. Asou teaches a chemical reaction to remove/purify CO, whereas the present invention teaches the physical removal of CO. Thus, Asou teaches away from the present invention, i.e., chemical versus physical removal/purification of CO.

Fourthly, Bonville teaches the use of an ammonia scrubber [52] after the two selective oxidizers [44 and 50] whereas the applicants' invention teaches the use of the CFCMS [13] to remove the chemically reduced forms of the contaminants. Bonville teaches away from the applicants' invention.

The rejection is overcome, and applicant respectfully requests withdrawal thereof.

Applicants confirm that no new matter is introduced with these amendments. In view of the above amendments and remarks, it is submitted that the Examiner's rejections are overcome, and that applicant's claims are in condition for allowance. Applicants therefore earnestly solicit allowance thereof, and the issue of U.S. letters patent therefore.

Respectfully submitted:

/Kirk A. Wilson/

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